3. Of the three sets of receiver tests (at –65, -55 and –45 dBm desired input signal strength) in the Carl T. Jones report for NAB (contained in NAB Study, Volume 2) the set of receiver tests chosen showed the worst possible receiver performance.

4. The NAB invents a "worst radio" in order to show much greater potential LPFM interference than would be experienced by any real receiver.

5. The NAB omits a comparable map of calculated interference from incumbent FM stations.

All these actions are evidence of the NAB's attempt to portray potential interference from LPFM as much worse than it would look in an objective analysis.

5.6.1 The NAB Over-Counted Affected Population

The NAB shows inflated figures for population affected by LPFM interference in the tabular analysis of their mapping study.[46]

Without any mention of underlying assumptions or methods of calculation, the NAB presents Tables 4 through 9 with columns labeled "Population Experiencing Interference with Different 2nd/3rd Adjacent Channel Protection Ratios." These tables appear to be calculations of the population covered by the

[46] NAB Mapping Study, pages 14-19.

interference areas shown on the maps. NAB says only "After plotting the interference areas for each of the markets...Dataworld then calculated the number of people who would be affected by this interference based on the 1990 US Census Data. Tables 4 through 9 summarize this data."[47]

The four columns are sub-labeled "FCC Ratios", "Clock/Personal", "Portable" and "Home Stereo." The first refers to a theoretical radio that would have the same interference rejection capability as the FCC interference protection ratios would predict – a radio that performs significantly better than most radios in use, according to studies. The last 3 refer to categories of radio types.

A careful review reveals that the population totals are greatest for Portable, next greatest for Clock/Personal, followed by Home Stereo and FCC Ratios in that order. This is true for all 6 tables. It's also true for individual rows of the tables in cities where more than one LPFM station was proposed.

The radio types, in descending order of performance, are FCC Ratios, Home Stereo, Clock/Personal, and Portable. This is the same order as the column totals, and the same order as the nested interference areas on the maps.

Thus, we see that each of the interference regions shown on the NAB's maps is nested, with the inner part representing interference to the best radios. The

[47] NAB Mapping Study, page 13.

outer part represents interference for the poorest radio. In other words, better radios can get closer to LPFM stations before they experience severe interference on incumbent stations' frequencies.

The only way the NAB could count the affected population to show the pattern of decreasing population with increasing radio performance would be to accumulate population with each nested interference area. Thus, "FCC Ratios" has only the people inside the FCC Ratios area, "Home Stereo" has all the people inside the Home Stereo area *and* the FCC Ratios area, and so on. The series ends with "Portable" including the population for every other radio type as well as the population under the green-shaded "Portable" areas on the maps.

Interpreting the Portable column as well as we can with limited information, it seems these totals assume:

- Every person in the largest interference area (Portable) has one of each of four types of radios,
- They listen to all four at the same time,
- They somehow know which radio stations they should receive based on protected contours, and
- They know whether or not they receive each station at a quality level of 50 dB S/N.

Another way to look at it is that the NAB has counted certain sets of the population four times, other sets three times, and so on. Since the methodology is not explained, these methods can only be interpreted as an attempt to inflate the NAB's case against LPFM without technical justification.

5.6.2 The NAB Failed to Document the Methods Used to Produce Their Mapping Study

An objective study would contain all calculations, source code, and methods clearly explained so that others could duplicate the results, if desired. The NAB seems to have avoided including their methods in the Volume 3 of their Comments, thus arousing suspicion that the maps and tables presented are not what they appear to be.

As reviewers, we require full disclosure of calculation methods and data inputs in order to make an objective analysis. The NAB has not provided the methods or assumptions behind the interference that they predict for LPFM. In particular, the report lacks:

- Propagation model details.
- How the affected population was calculated.
- Details of any Geographic Information System (GIS) data used in the analysis.
- What protections were assumed in the placement of the LPFM stations.

- Which of the 9 scenarios run by the FCC to discover how many LPFM stations might be placed in major cities was used in reconstructing the list of LPFM stations mapped.

Ordinarily a technical report of this type includes enough information about the methods and formulas used that other researchers can reproduce the work independently. Omitting this information invites doubt as to the actual source of the results: calculations and scientific analysis, or wishful thinking. It also limits the utility of the work for further research, because others cannot determine exactly how applicable the work is to a new problem.

For example, there are many propagation models that estimate the signal power of a radio wave. Some are more accurate at FM frequencies than others. Since they are not detailed, we cannot assess the accuracy of the interference predictions on the NAB's maps.

5.6.3 Choice of Receiver Test Results

The NAB chose to use the worst of 3 sets of receiver test results when another set would have been the obvious fair and objective choice.

The NAB performed receiver tests with three different desired input signal level settings to three different power levels: -45 dBm, -55 dBm and –65 dBm. At the fringe of an FM stations' protected coverage area, signal power should be about –55 dBm. But for the mapping analysis, NAB chose receiver test results for

–45 dBm desired signal power, rather than those at –55 or –65 dBm. Their reasons for this choice are unclear.

It should be noted that measurements for the more logical choice of –55 dBm desired signal power show better receiver performance. We believe the –45 dBm results were used because they are the worst.

5.6.4 The NAB Invents a "Worst Radio"

The NAB used a fictional "worst radio" to inflate the size of potential LPFM interference areas.

Appendix B[48] contains maps with an additional contour called the "worst radio." The worst 2nd adjacent interference rejection performance found for any of the 28 tested radios was combined with the worst 3rd adjacent performance of any radio. The two measurements were taken from different receivers.[49] Therefore the "worst radio" does not exist. Given that we have already demonstrated that NAB's test sample was biased towards lower-quality radios, this invention of a worst radio is extraordinary. NAB tries to explain this approach by stating, "There may be receivers, new or old, that do not perform as well as our 'worst radio' data."[50] The logical extension of this argument ends with radios

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[48] NAB Mapping Study.

[49] NAB Mapping Study, page 12.

[50] NAB Study, Volume 3, page 12.

that do not work at all, but no one suggests making communications policy based on the presence of non-functional radios.

We find a serious conflict between the assumption of a "worst radio" and the NAB's assertion that the 28 receivers tested were a broad, representative sample.

Taken together, the "worst radio" concept and the exclusion of car radios from the mapping analysis (see Section 5.2.1) point clearly to the NAB's intention to exaggerate potential LPFM interference beyond any levels indicated by realistic assumptions.

5.6.5 No Map of Current FM Interference Provided

Although the NAB produced maps of potential interference after the introduction of LPFM, it did not produce a map of current FM interference for comparison. Showing only LPFM interference implies that no FM interference exists now, which is impossible. We believe this was omitted because it would have weakened the NAB's contention that LPFM stations will cause more interference than FM listeners have yet been exposed to.

An objective analysis of this type would include maps and calculations showing the interference caused by existing FM stations solely to each other. Such a plot would serve as an experimental control and baseline reference for evaluating maps of interference caused by only LPFM stations. NAB does not include any mention of existing FM interference – though the tested FM receivers would see plenty of interference in the current environment without LPFM.

5.7 FM Receiver Test Equipment and Connections

The radio tests themselves, as described in the reports, were straightforward. We found no faults in the connections or choice of measurement equipment. Implicit in all of the tests was the assumption that the receiver would be stationary, since no fading of any kind was injected into the desired or undesired signals.

Any differences in choice of peak, quasi-peak or weighted quasi-peak readings were small and tend to be swamped by the original choice of test assumptions or data manipulation. BSL took care to evaluate receiver performance in a wide range of modulated signal formats, including formats similar to digital radio, and found little overall difference in most of the receivers.

6 Simulation to Determine Viable LPFM Stations

Following FCC techniques, we determine the available channels, possible locations, and interference and coverage contour radii for LPFM transmitters of varying transmit powers in 60 representative markets. We are then able to estimate the average number of listeners who will be able to receive programming or who might receive adjacent channel interference from LPFM stations of four different power levels.

We conclude that LP1000 stations are hard to place in crowded FM markets because very little of the FM band remains unused. New FM stations are authorized each month, lessening the spectral space available to LPFM.

LP100 stations can be placed more easily, due to their shorter required separation distances. The same is true to a greater extent with LP10 and LP1 stations. Our analysis probably underestimates the number of possible LP100 to LP1 stations because we assume that antenna heights for 100, 10 and 1 Watt stations are 30 meters HAAT. In practice, most LPFM antennas are likely to be much closer to the ground, thereby reducing the interference and coverage areas below those of stations with 30-meter high antennas.

In the 60 cities considered here, a total population of 38.5 million citizens is represented. If LPFM is instituted with all standard FM protection ratios with the exception of 2^{nd} and 3^{rd} adjacent channels, 626 100-Watt LP stations can be made available. These stations would provide alternative programming coverage to 81.1 Million citizen-channels, where one citizen-channel represents the ability of one person to receive a single LPFM station. These 626 100-Watt LP stations could potentially interfere with a maximum of 1.2 million citizen-channels, providing a public service to interference ratio of about 64. We use the term "citizen-channel" because the modified FCC LPFM program and the maps in the appendix show there are numerous locations in each city where more than one LPFM station may be placed. Consequently, many citizens will be able to receive more than one LPFM station at some locations, and may also receive interference from more than one LPFM station at some locations, and thus the number of citizen-channels exceeds the actual population in some cases. Nevertheless, the *ratio* of citizens served by LPFM to citizens interfered with by LPFM is exactly the same as the ratio of citizen-channels.

Alternatively, 766 10-Watt LP stations could be made available to serve 31.6 million citizen-channels, while interfering with 158 thousand citizen-channels. This yields a public service to interference ratio of about 200. Or, 797 1-Watt LP stations could be made available to 11.1 million people while providing interference to only 16,300, thus yielding a service to interference ratio of about 680. It would also be possible to mix various LP power levels. Modifying the program to accommodate a mix of LPFM powers would not be difficult. In conclusion, it can be seen that between 64 and 680 times as many people gain access to LPFM broadcasts as may rarely experience interference from LPFM (Table 12). As a worst case, only 1.6% of the public would experience some type of adjacent channel interference from LPFM, and that would only be from LP100 stations and only if all conditions occurred as described earlier. We believe the actual percentage of the population experiencing any kind of trouble would be significantly less than 1.6%.

Table 12. Summary of LPFM Simulation Results, Showing Proportion of Newly Served Population Who May Be Affected By Interference. The LP1000 stations have full protection, and LP100 – LP1 have full protection except for no 2nd adjacent and 3rd adjacent channel protection.

LPFM Power (Watts)	New LPFM Station Count	Maximum citizen-channels affected by Interference	Maximum citizen-channels served by all LPFM Stations	Percent of Those Served Who Might Experience Interference
1	797	16,262	11,052,430	0.1%
10	766	157,911	31,634,873	0.5%
100	626	1,262,455	81,066,457	1.6%
1000	34	0	23,160,193	0%

Table 12 illustrates the tradeoff between the number of new radio voices enabled by LPFM, the size of the newly served population, and the proportion of those who may be affected by interference. (LP1000 calculations were based on full interference protection and thus would not interfere with any other existing FM stations.)

In preparing their NPRM, the FCC developed a computer program for estimating the number of LPFM stations of 1000 and 100 Watts that could be placed in each of 60 major US cities. The FCC has relied on such analysis and computer simulation methods over the past several decades to successfully assign licenses to nearly ten thousand FM broadcasters, as well as in its NPRM. The program draws upon the ever-changing database of FM stations, Channel 6 TV stations and FM translators and applications for all of the above maintained by the FCC. It calculates the possible positions and channels for LPFM stations on a grid square with 1 minute by 1 minute spacing, based on the regulations for coverage and interference given in Part 73. Options for the overall area include 10x10, 20x20 and 30x30 minute grid squares.

We obtained from the FCC the source code for this program as well as the database of FM transmitter stations dated August 9, 1999. In addition, files with the Mexico and Canada transmitters, and water files for 16 cities were obtained from the FCC. We expanded the capabilities of the program by adding the following options:

- The ability to place LP10 and LP1 stations in the city of interest.
- Increased the granularity to half-minute by half-minute grid size and quarter-minute by quarter-minute grid size in order to more accurately discretize the contours of LPFM stations.
- Increased area of 60x60 grid squares (except for cities near water) to expand the coverage region of the analysis within a particular city.

Our version of the program was verified for accuracy in a test to find the number of LP1000 stations for Phoenix, AZ. Using the current version of the FM database and the same input conditions, the same results were obtained by us and by FCC engineer Jordan Brinn, who ran the original version of the program at the FCC.[51]

Inputs to the modified program include:

1. Name of city to be analyzed (spelling must be exact to match FCC station database).
2. Geographical coordinates of the center of the city (these were obtained from the FCC).
3. Area of analysis (specified in terms of grid squares).
4. Granularity (size of a single grid "bin").
5. Transmit power of LPFM station to be placed in the city.
6. Yes/No options for retaining 2nd and 3rd adjacent protection.
7. Population and square area of each city.

Outputs from the program include:

1. Number of available channels.

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[51] Conversation between Roger Skidmore, Vice President of Engineering, Wireless Valley Communications and Jordan Brinn, Engineer, Audio Services Division, Mass Media Bureau, Federal Communications Commission, August 20, 1999.

2. A list of the available channels.

3. The grid bin locations in which a LPFM transmitter for a particular FM channel may be placed.

4. The average population per square mile.

5. The total audience reached by all allowable LPFM stations in the city.

6. The maximum (worst case) possible number of people who would experience interference from all LPFM stations in the city (assuming 100 dBu interference boundary for each LPFM station).

The number of stations calculated by our program does not exactly match those listed in the NPRM because the version of the FM database used last January when the NPRM was prepared is no longer available from the FCC.

A small sample of the program output, using a collection of 30x30 grid squares, each with 30-seconds per side is presented in Table 13. 2^{nd} and 3^{rd} adjacent protections were ignored for this example. The table shows the number of LPFM stations that could be placed. See Appendix B for results for all 60 cities and Appendices C and D for a complete printout of computed results for a wide range of inputs in all 60 cities. Appendix E contains user instructions for the Wireless Valley LPFM program that generated these results.

It is worth noting that depending upon the granularity selected by the user, it is possible to get a +/- 1 difference in the number of available channels for LPFM in a particular market.

Appendix A contains color-coded maps of 10 cities, showing the possible locations for LP100 and LP10 stations. Calculations for these maps came directly from the modified FCC LPFM program, assuming a 30 x 30-minute grid using 1-minute resolution, and no 2nd or 3rd adjacent channel protection. All other protections were retained.

Table 13. Count of Allowable LPFM Stations in 5 Cities

City	LP1000	LP100	LP10	LP1
Los Angeles	0	0	1	2
San Francisco	0	0	5	5
Phoenix	4	12	19	20
Detroit	2	4	4	4
Boston	2	5	5	6

7 IBOC DAB and LPFM

In-Band, On Channel Digital Audio Broadcasting (IBOC DAB) proponents' concerns about LPFM are significantly based on the cost of future hybrid digital-analog receivers. This cost-performance tradeoff is no different from the cost-performance tradeoff of any new category of radio receiver.

To the extent that IBOC proponents concerns are about the technical limits of their developing technology, their concerns are focused on the potential loss of 2nd adjacent channel interference protection. We find these concerns to be unwarranted.

Second adjacent protection for LPFM stations of 100 Watts and lower is not necessary to protect IBOC DAB transmissions. Digital radio has been engineered to perform acceptably well in the current FM interference environment. LPFM will not significantly change that environment, and therefore will have an insignificant impact on digital broadcasting.

Section 7.1 below discusses the background and issues surrounding digital audio broadcasting as it is envisioned by USA Digital Radio and others.

The cost pressures on IBOC DAB receivers is discussed in Section 7.2

Sections 7.3 and 7.4 explain what impact LPFM will have on digital radio.

Section 7.5 concerns assertions made about the incumbent FM service contour radius and demonstrates why one particular LPFM placement configuration examined in the USADR Study should be of no concern to digital radio.

7.1 Digital Audio Broadcasting Background

IBOC DAB can potentially transmit two different programs on the same FM channel: one analog and one digital. Broadcasters plan to continue analog FM service while duplicating their programming on the digital portion of the signal. In decades to come, when DAB receivers have replaced nearly every one of the 700+ million FM receivers currently in use, the service will convert wholly to digital.[52]

Digital broadcasters intend to try datacasting on digital subcarriers, again within the same FM radio channel. Digital broadcasters and DAB receiver manufacturers are concerned that FM interference will limit the usability (and therefore profit potential) of subcarrier data services. It should be noted that analog subcarriers have been used for background music services and reading services for many years, and operate very well in the current FM interference environment. Our proposed enforcement of 1st adjacent channel protection will

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[52] No technical reason prevents broadcasters from transmitting a completely separate program on the recovered analog portion of their FM channel. DAB, therefore, represents a potential for "free spectrum." Spectrum, like land, is valuable because it is ultimately a limited resource. The value of radio spectrum is

maintain good performance for DAB. Since the IBOC DAB subcarrier services are engineered for the existing FM environment, they should be robust enough to succeed.

IBOC DAB works with a reduced guard band between FM channels. A guard band is like the median area of a divided highway: it provides a needed separation between channels in which no one is allowed to broadcast.

The size of the guard band is driven purely by receiver filter capability. Practical analog filters require a guard band larger than the one intended for DAB, but digital filters can easily handle the smaller channel spacing. The tradeoff is that the hardware for implementing the digital filter is more expensive.

IBOC DAB has been designed to work best with all stations converted to digital. Special filtering takes place in the transmitter to reduce the amount of signal "leaking" into the adjacent channels. Less energy in the adjacent channels means digital radios can decode more distant transmissions, enhancing the digital coverage of all FM stations.

Analog FM stations also place a small amount of unwanted energy in adjacent channels, because transmitters will always be imperfect. However,

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growing with the public's desire to be unwired: free from the traditional stationary telephone and computer connections.

according to the AFCCE,[53] modern stations emit far less power in adjacent channels than FCC regulations require.

7.2 Digital Receiver Cost Pressures Drive Concerns Over Interference

IBOC proponents are concerned about LPFM, in part, because it costs more money to manufacture radios that reject interference well, and an increased radio cost may delay or decrease consumer acceptance. The cost of DAB receivers will be driven by 2 factors. First is the processor capability of the digital filters and second is whether hybrid DAB receivers will employ a single analog front end or both digital and analog front ends. The interference level impacts both of these factors, but the interference levels and price/performance tradeoffs for DAB receivers are the same as for analog receivers.

USADR comments do not mention 3rd adjacent interference. This is because the digital filters already designed for DAB receivers reject 3rd adjacent interference very well. The effectiveness of any filter increases with channel separation, but this is especially true for digital filters. Inexpensive digital filters for rejecting power on 3rd adjacent channels can be made in a variety of ways.

[53] "Comments of the AFCCE on Notice of Proposed Rulemaking", August 2, 1999, page 11.

Interference on 2nd adjacent channels is more difficult to filter out than 3rd adjacent channels. It can be done effectively with digital filters implemented on faster digital signal processor (DSP) chips or microprocessors specially designed for baseband detection and filtering. Faster DSP chips, like faster computer processors, cost more.

It is possible that digital radio manufacturers intend to structure their products around poor quality analog front ends, rather than digital filters implemented using DSP. USADR studied RF filters "...commonly found in portable and personal radios."[54] Portable and personal radios were found to be the worst performing of any category by several independent tests of FM receivers.

Digital radio manufacturers are in a position to make several cost/performance tradeoffs. From a hardware point of view, an analog front end could be seen as more cost-effective. Hybrid models will make up the first generation of DAB receivers, capable of decoding the digital portion of the broadcast until it degrades too much, then switching to analog mode in difficult reception conditions. A single analog front end can feed both the analog and digital sections of the radio. The more expensive option is to build separate analog and digital front end circuits. Even though similar concerns surround

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[54] Comments of USA Digital Radio, Inc., August 2, 1999, p. 8.

today's analog FM car radios, USADR asserts that "Even if... areas of interference are limited to a specific geographic area, repeated loss of the signal as a mobile user enters and exits various LPFM service areas will significantly degrade the listener's experience."[55] USADR does not account for the fact that most car radios today already perform to high specification levels and cost significantly more than other radios.[56] Nothing will prevent manufacturers from making and selling high quality expensive car radios for IBOC DAB, just as they have for analog FM.

Digital radio manufacturers will simply be able to repeat the pattern they established for analog FM radio manufacturing. That is, cheap radios will receive fewer DAB stations than more costly ones and the market will find the right balance of cost and quality in each receiver category.

IBOC DAB has been designed to work in the current FM interference environment. Any concerns over greater interference need to be addressed to all additional FM stations, not just LPFM. The addition of LPFM, which will impact a very small percentage of the listening public, and in very small zones, is a miniscule interference source when compared to the current FM environment.

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[55] Comments of USA Digital Radio, Inc., August 2, 1999, p. 9.

[56] Car radios face a more challenging reception environment because they move at high speed through the peaks and valleys of FM signal power. To provide acceptable reception quality, they must incorporate more expensive filtering and better-performing circuit designs. This makes them more expensive than personal and portable radios.

7.3 IBOC DAB and LP1000 Stations

If LP 1000 stations are granted interference protection responsibilities similar to other primary FM stations, we conclude that LP1000 stations pose no threat to IBOC DAB.

DAB will be most challenged in dense radio markets where LPFM stations are hardest to place. Certainly DAB receivers will be designed with sufficient quality for consumer acceptance in New York and Los Angeles, where no LP1000 stations can be located. Adding LP1000 stations to smaller radio markets will *at worst* bring the interference levels up to equal that of the biggest markets.

7.4 IBOC DAB and LP100 to LP1 Stations

LPFM stations of 100W or less will not significantly change the interference level in any market if they are placed according to reasonable separation rules which take into account the co-channel and first adjacent channel neighbors, as well as the standard FM transmission spectrum mask rules.

Because LPFM can be introduced into the present analog FM environment and IBOC DAB is designed to work in the present analog FM environment, digital FM broadcasting should not be harmed by LPFM.

7.5 Review of Engineering Statement Submitted with Comments of USA Digital Radio, Inc. (USADR)

The Engineering Statement[57] submitted as part of USADR's comments claims relaxing 2nd adjacent protection rules for LPFM stations could disrupt IBOC DAB transmissions in areas outside the protected contour of the primary station. They assume the "real" service contour of incumbent FM stations is near the 44 dBu contour. FCC rules protect the service contour of most stations to 60 dBu, except commercial class B1 stations to 54 dBu and commercial class B stations to 57 dBu. However, we doubt many FM stations have been unwise enough to base their business plans on the unprotected 44 dBu contour.

The statement authors envision two LPFM stations on channels that are 2nd adjacent to each other and first adjacent to a primary station. Further, they assume the LPFM stations will be close to each other, and that they are also inside the 44 dBu contour of the primary station.

Given the scarcity of FM channels available for LPFM and the varied purposes for which community broadcasters can use LPFM, even if we considered the 44 dBu contour protected (which has no basis in any FCC rule), USADR's worries seem extreme. Further, the USADR study focuses on LP1000 stations, for which we recommend retaining full adjacent channel protections. The threat from

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[57] Engineering Statement In Support of the Comments of USA Digital Radio, Inc., Moffet, Larson & Johnson, Inc., August 2, 1999.

LP100 – LP1 stations co-located inside the 44 dBu contour of a primary FM station on 2nd adjacent channels and first adjacent to the primary FM station is very small.

The reason this rare circumstance is of concern to USADR has to do with the way the digital portion of the IBOC signal is transmitted. IBOC transmits redundant information in upper and lower sidebands of the FM channel, leaving the center for the standard analog FM transmission. If interference temporarily interrupts the data stream from the upper sideband, the program can be reconstructed from the lower sideband data stream and vice versa. Sideband redundancy is a major feature of the robustness of IBOC DAB because simultaneous interference to both upper and sidebands is much less likely than interference bursts from each adjacent channel singly. Sidebands are most threatened by first adjacent channel interference. If two stations interfere, one on the upper first adjacent channel and the other on the lower adjacent channel, IBOC will not work.

Since interference areas are so small for LPFM stations, and since channels available for LPFM are so rare, IBOC DAB proponents need not fret over potential "pockets" of two-sided first adjacent interference.

8 Conclusions

LP1000 stations should be authorized if and where they can adhere to the existing FCC separation rules for FM stations, including full protection for 2nd and 3rd adjacent channel interference.

LPFM stations of 1 to 100 Watts should be licensed if and where they can adhere to all existing FCC separation rules for FM stations *except* those for 2nd and 3rd adjacent channel interference. The benefit of such stations far outweighs the small potential for 2nd and 3rd adjacent channel interference to incumbent stations.

Our calculations show that many hundreds of LPFM stations could be introduced, providing new FM service to tens of millions, in all but the most FM-congested cities. The number of served citizens versus citizens who might experience interference from LPFM is greater than 64 times, and can be as much as 680 times.

Radio receiver tests by NAB and CEMA comparing FM receiver performance to FCC interference protection ratios miss the point on two counts: 1. The FCC's proposal to relax 2nd and 3rd adjacent channel protection for LPFM is strengthened by evidence that modern FM receivers perform acceptably with much more severe interference environments than assumed by the FCC protection ratios, and 2. The FCC protection ratios were designed for early generation FM receivers, which were more susceptible to frequency drift and adjacent capture than today's FM receivers. As a result, today's FM receivers tolerate the existing FM interference environment very easily, and a minute increase in 2nd and 3rd adjacent channel interference, due to the relatively small number of LPFM stations, will have a negligible effect on radios used by the listening public.

It is unclear how NAB computed the population potentially affected by LPFM interference in its mapping study and may have misrepresented the population affected. In contrast, we have presented here a detailed analysis regarding the affected population, with all assumptions clearly disclosed for replication and validation of results.

The quality criteria selected by CEMA and NAB for their FM receiver tests were not formulated with enough objective rigor to offer sufficient input to the FM regulatory process regarding licensing regulations for adjacent channel interference.

LPFM will have no significant deleterious effects on the reception of incumbent FM stations, subcarrier services, or future IBOC DAB services.